

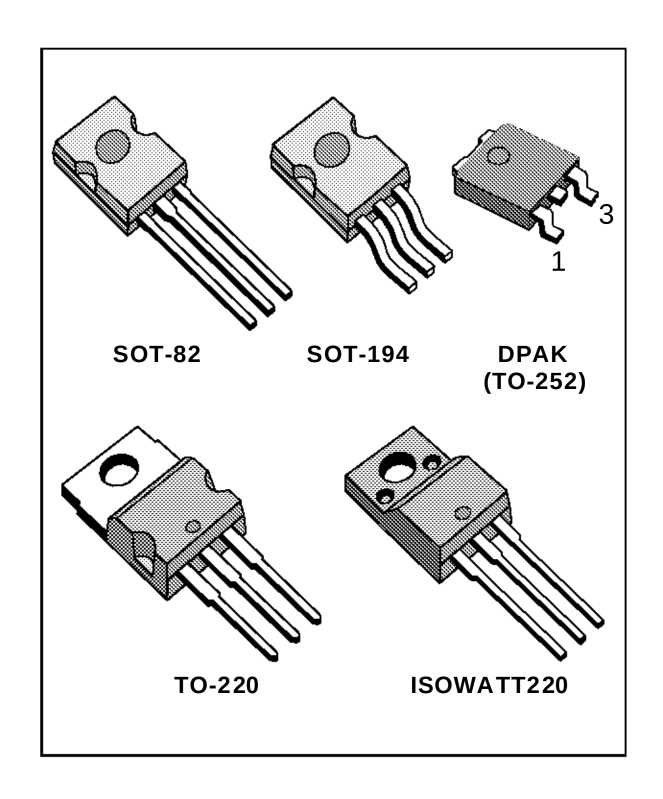
L78M00 SERIES

POSITIVE VOLTAGE REGULATORS

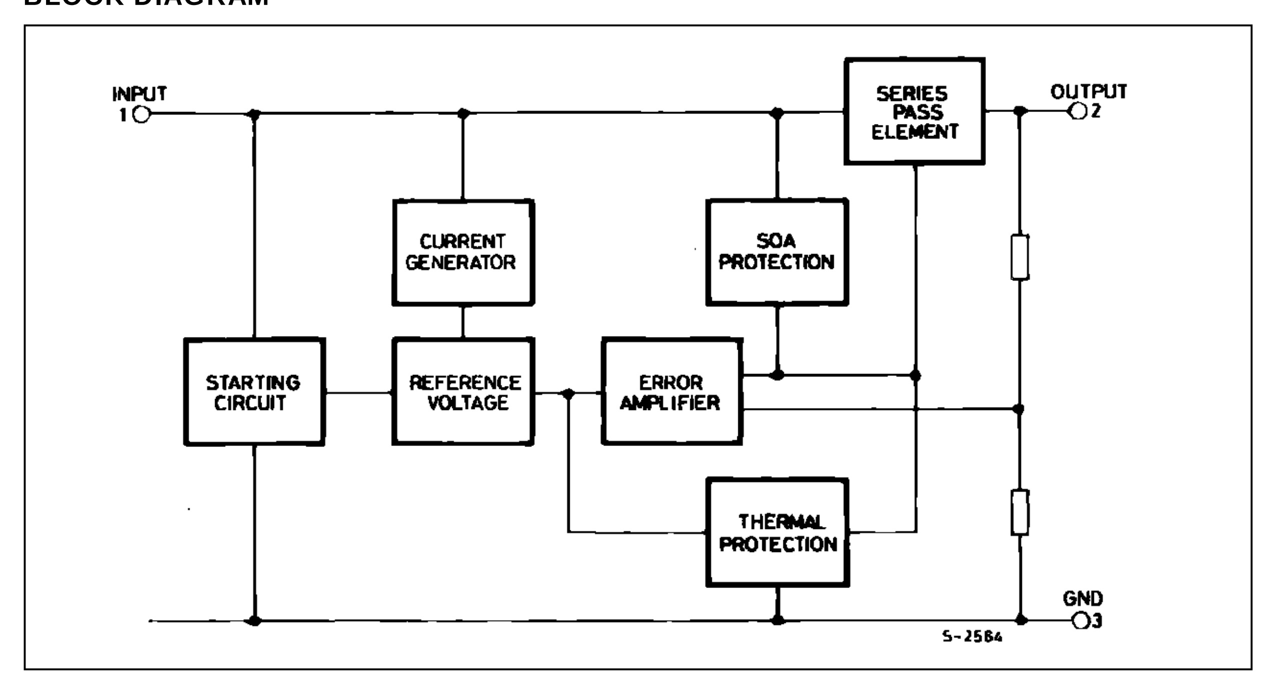
- OUTPUT CURRENT TO 0.5A
- OUTPUT VOLTAGES OF 5; 6; 8; 9; 10; 12; 15; 18; 20; 24V
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- OUTPUT TRANSISTOR SOA PROTECTION

DESCRIPTION

The L78M00 series of three-terminal positive regulators is available in TO-220, ISOWATT220, SOT-82, SOT-194 and DPAK packages and with several fixed output voltages, making it useful in a wide range of applications. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.



BLOCK DIAGRAM



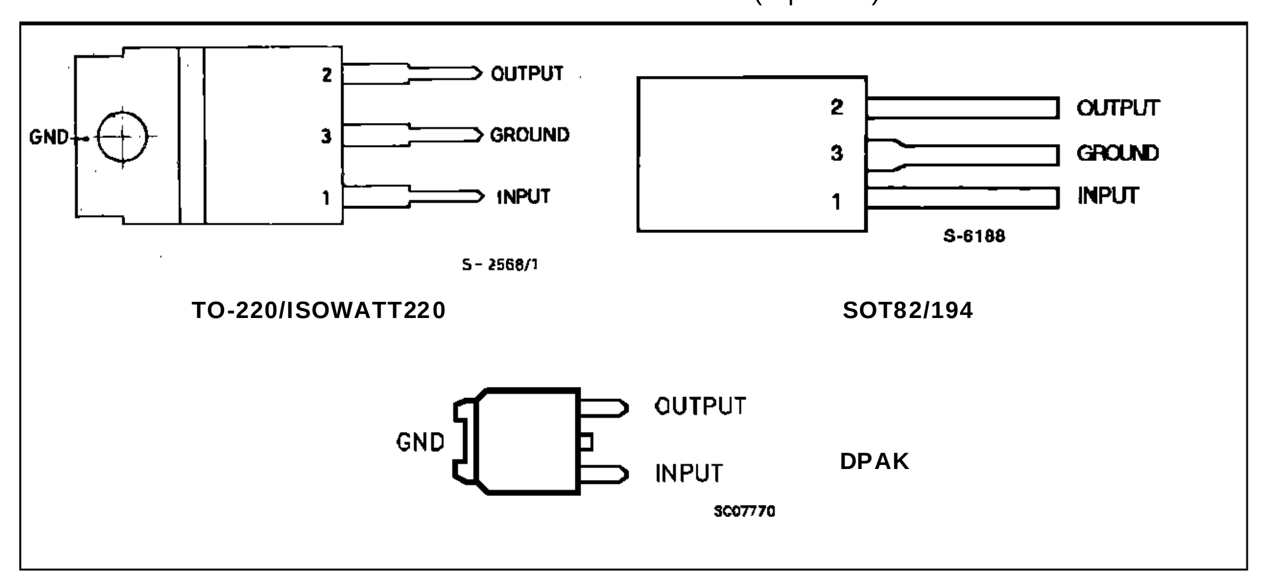
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_i	DC Input Voltage (for V_o = 5 to 18V) (for V_o = 20, 24V)	35 40	V V
I_o	Output Current	Internally limited	
P_{tot}	Power Dissipation	Internally limited	
T_{stg}	Storage Temperature	– 65 to + 150	°C
T_{op}	Operating Junction Temperature	0 to + 150	°C

THERMAL DATA

Symbol	Parameter		SOT-82 SOT-194 DPAK	TO-220	ISOWATT220	Unit
$R_{thj-case}$	Thermal Resistance Junction-case	Max	8	3	4	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	100	50	60	°C/W

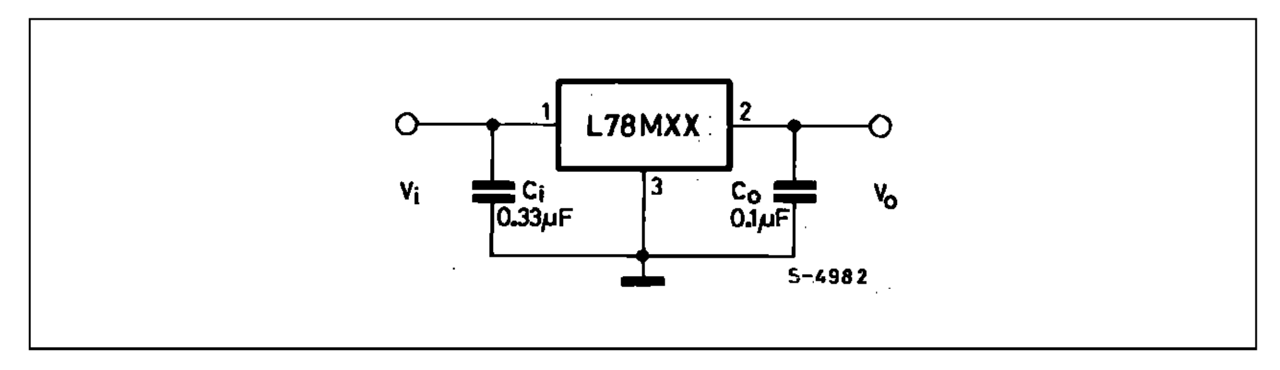
CONNECTION DIAGRAM AND ORDERING NUMBERS (top view)



Order Code					Output Voltage
TO-220	ISOWATT220	SOT-82	SOT-194	DPAK	
L78M05CV	L78M05CP	L78M05CX	L78M05CS	L78M05CDT	5V
L78M06CV	L78M06CP	L78M06CX	L78M06CS	L78M06CDT	6V
L78M08CV	L78M08CP	L78M08CX	L78M08CS	L78M08CDT	8V
L78M09CV	L78M09CP	L78M09CX	L78M09CS	L78M09CDT	9V
L78M10CV	L78M10CP	L78M10CX	L78M10CS	L78M10CDT	10V
L78M12CV	L78M12CP	L78M12CX	L78M12CS	L78M12CDT	12V
L78M15CV	L78M15CP	L78M15CX	L78M15CS	L78M15CDT	15V
L78M18CV	L78M18CP	L78M18CX	L78M18CS	L78M18CDT	18V
L78M20CV	L78M20CP	L78M20CX	L78M20CS	L78M20CDT	20V
L78M24CV	L78M24CP	L78M24CX	L78M24CS	L78M24CDT	24V



APPLICATION CIRCUIT



SCHEMATIC DIAGRAM

TEST CIRCUITS

Figure 1 : DC Parameters.

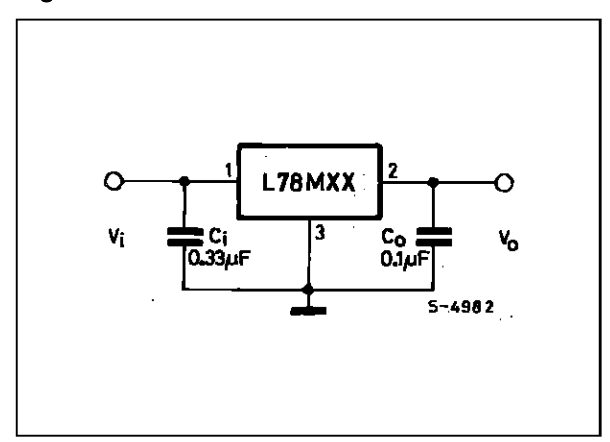


Figure 2 : Load Regulation.

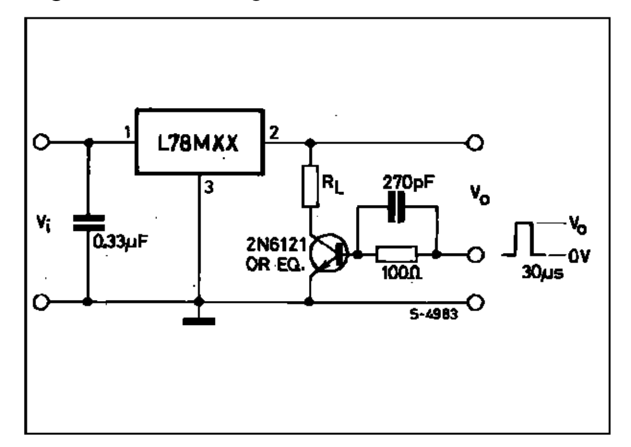
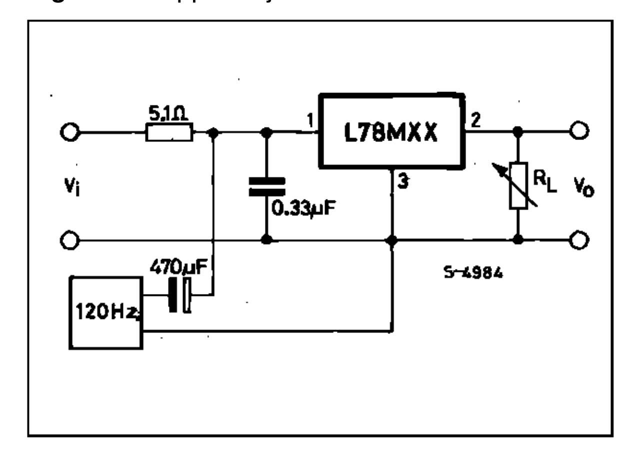


Figure 3 : Ripple Rejection.



ELECTRICAL CHARACTERISTICS FOR L78M05C (refer to the test circuits, T_j = 25 °C, V_i = 10V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		4.8	5	5.2	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 7 to 20 V	4.75	5	5.25	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 7 to 25 V I_o = 200 mA V_i = 8 to 25 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 °C I_o = 5 to 200 mA T_j = 25 °C			100 50	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 8 to 25 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 °C		-0.5		mV/°C
e_N	Output Noise Voltage	B = 10Hz to 100KHz		40		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 8 to 18 V	62			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		300		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M06C (refer to the test circuits, T_j = 25 °C, V_i = 11V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		5.75	6	6.25	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 8 to 21 V	5.7	6	6.3	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 8 to 25 V I_o = 200 mA V_i = 9 to 25 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 °C I_o = 5 to 200 mA T_j = 25 °C			120 60	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 9 to 25 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 °C		-0.5		mV/°C
e_N	Output Noise Voltage	B = 10Hz to 100KHz		45		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 9 to 19 V	59			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		270		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M08C (refer to the test circuits, T_j = 25 ^oC, V_i = 14V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		7.7	8	8.3	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 10.5 to 23 V	7.6	8	8.4	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 10.5 to 25 V I_o = 200 mA V_i = 11 to 25 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 ^oC I_o = 5 to 200 mA T_j = 25 ^oC			160 80	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 10.5 to 25 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 ^oC		-0.5		mV/^oC
e_N	Output Noise Voltage	B = 10Hz to 100KHz		52		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 11.5 to 21.5 V	56			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		250		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M09C (refer to the test circuits, T_j = 25 ^oC, V_i = 15V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		8.65	9	9.35	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 11.5 to 24 V	8.55	9	9.45	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 11.5 to 25 V I_o = 200 mA V_i = 12 to 25 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 ^oC I_o = 5 to 200 mA T_j = 25 ^oC			180 90	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 11.5 to 25 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 ^oC		-0.5		mV/^oC
e_N	Output Noise Voltage	B = 10Hz to 100KHz		58		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 12.5 to 23 V	56			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		250		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M10C (refer to the test circuits, T_j = 25 °C, V_i = 16V, I_o = 350 mA, C_i = 0.33 µF, C_o = 0.1 µF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		9.6	10	10.4	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 12.5 to 25 V	9.5	10	10.5	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 12.5 to 30 V I_o = 200 mA V_i = 13 to 30 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 °C I_o = 5 to 200 mA T_j = 25 °C			200 100	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 12.5 to 30 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 °C		-0.5		mV/°C
e_N	Output Noise Voltage	B = 10Hz to 100KHz		64		µV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 13.5 to 24 V	56			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		245		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M12C (refer to the test circuits, T_j = 25 °C, V_i = 19V, I_o = 350 mA, C_i = 0.33 µF, C_o = 0.1 µF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		11.5	12	12.5	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 14.5 to 27 V	11.4	12	12.6	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 14.5 to 30 V I_o = 200 mA V_i = 16 to 30 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 °C I_o = 5 to 200 mA T_j = 25 °C			240 120	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 14.5 to 30 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 °C		-1		mV/°C
e_N	Output Noise Voltage	B = 10Hz to 100KHz		75		µV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 15 to 25 V	55			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		240		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M15C (refer to the test circuits, T_j = 25 °C, V_i = 23V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		14.4	15	15.6	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 17.5 to 30 V	14.25	15	15.75	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 17.5 to 30 V I_o = 200 mA V_i = 20 to 30 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 °C I_o = 5 to 200 mA T_j = 25 °C			300 150	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 17.5 to 30 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 °C		-1		mV/°C
e_N	Output Noise Voltage	B = 10Hz to 100KHz		90		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 18.5 to 28.5 V	54			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		240		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M18C (refer to the test circuits, T_j = 25 °C, V_i = 26V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		17.3	18	18.7	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 20.5 to 33 V	17.1	18	18.9	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 21 to 33 V I_o = 200 mA V_i = 24 to 33 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 °C I_o = 5 to 200 mA T_j = 25 °C			360 180	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 21 to 33 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 °C		-1.1		mV/°C
e_N	Output Noise Voltage	B = 10Hz to 100KHz		100		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 22 to 32 V	53			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		240		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M20C (refer to the test circuits, T_j = 25 ^oC, V_i = 29V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		19.2	20	20.8	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 23 to 35 V	19	20	21	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 23 to 35 V I_o = 200 mA V_i = 24 to 35 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 ^oC I_o = 5 to 200 mA T_j = 25 ^oC			400 200	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 23 to 35 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 ^oC		-1.1		mV/^oC
e_N	Output Noise Voltage	B = 10Hz to 100KHz		110		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 24 to 34 V	53			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		240		mA
I_{scp}	Short Circuit Peack Current			700		mA

ELECTRICAL CHARACTERISTICS FOR L78M24C (refer to the test circuits, T_j = 25 ^oC, V_i = 33V, I_o = 350 mA, C_i = 0.33 μF, C_o = 0.1 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage		23	24	25	V
V_o	Output Voltage	I_o = 5 mA to 350 mA V_i = 27 to 38 V	22.8	24	25.2	V
ΔV_o	Line Regulation	I_o = 200 mA V_i = 27 to 38 V I_o = 200 mA V_i = 28 to 38 V			100 50	mV mV
ΔV_o	Load Regulation	I_o = 5 to 500 mA T_j = 25 ^oC I_o = 5 to 200 mA T_j = 25 ^oC			480 240	mV mV
I_d	Quiescent Current				6	mA
ΔI_d	Quiescent Current Change	I_o = 5 to 350 mA			0.5	mA
ΔI_d	Quiescent Current Change	I_o = 200 mA V_i = 27 to 38 V			0.8	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift	I_o = 5 mA T_j = 0 to 125 ^oC		-1.2		mV/^oC
e_N	Output Noise Voltage	B = 10Hz to 100KHz		170		μV
SVR	Supply Voltage Rejection	I_o = 300 mA f = 120 Hz V_i = 28 to 38 V	50			dB
V_d	Dropout Voltage			2		V
I_{sc}	Short Circuit Current	V_i = 35 V		240		mA
I_{scp}	Short Circuit Peack Current			700		mA

Figure 4 : Dropout Voltage vs. Junction Temperature.

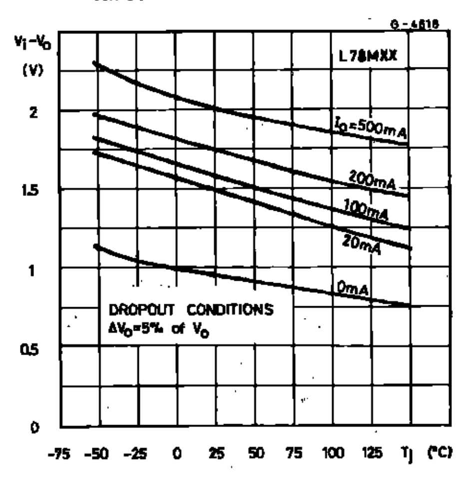


Figure 5 : Dropout Characteristics.

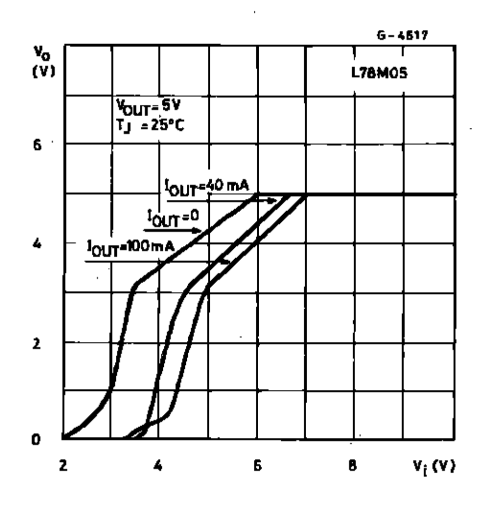


Figure 6 : Peak Output Current vs. Input-Output Differential Voltage.

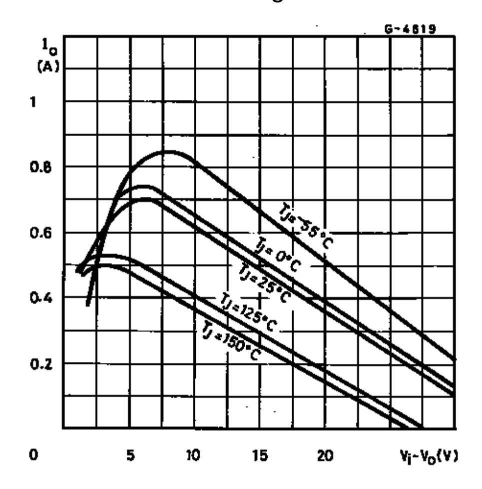


Figure 7 : Output Voltage vs. Junction Temperature.

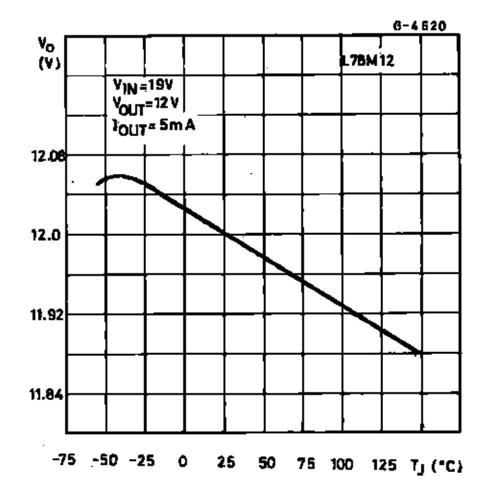


Figure 8 : Supply Voltage Rejection vs. Frequency.

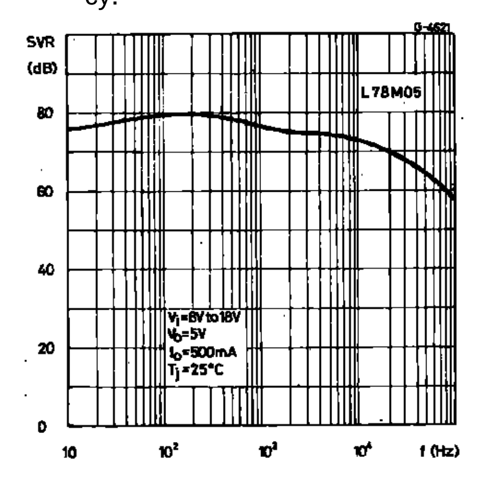


Figure 9 : Quiescent Current vs. Junction Temperature.

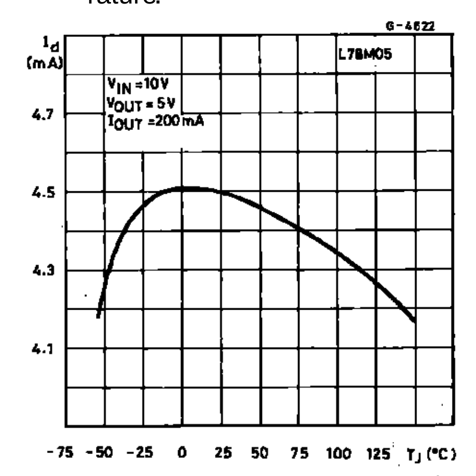


Figure 10 : Load Transient Response.

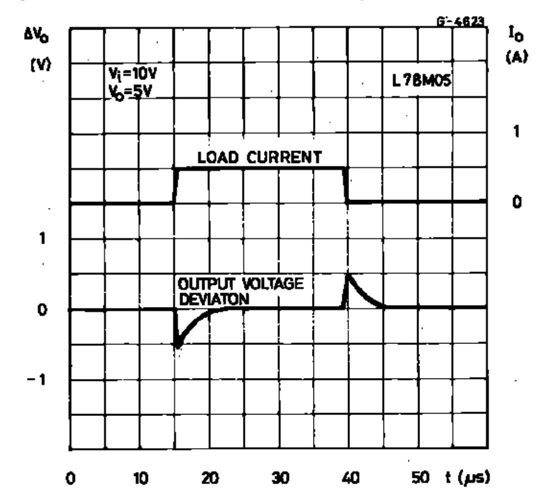


Figure 11 : Line Transient Response.

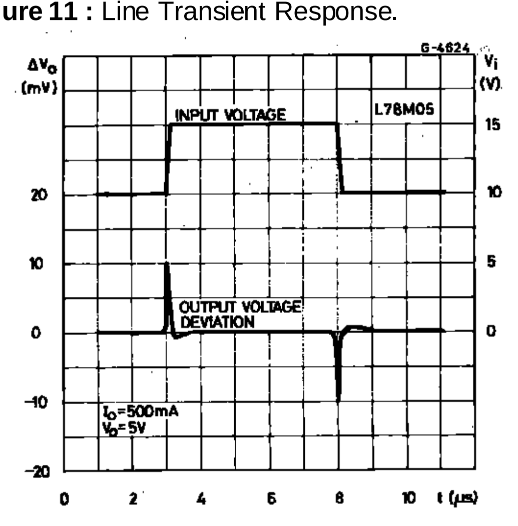


Figure 12 : Quiescent Current vs. Input Voltage.

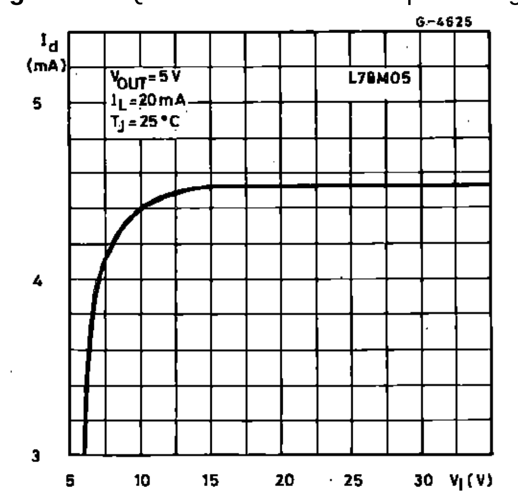
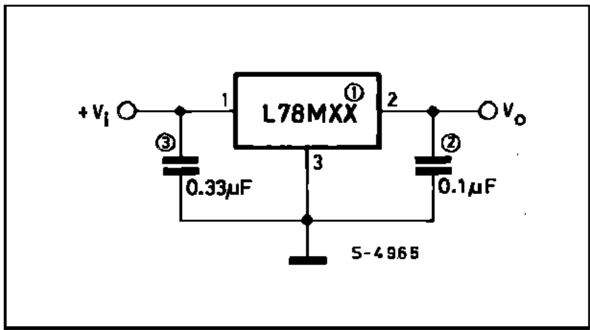
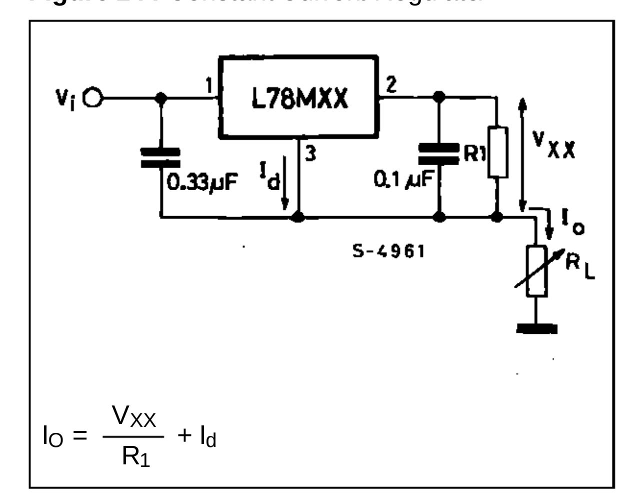


Figure 13 : Fixed Output Regulator.



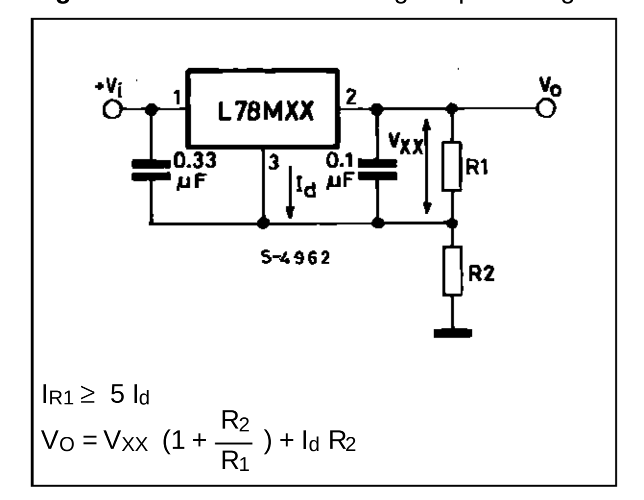
Notes :
1. To specify an output voltage, substitute voltage value for ”XX”.
2. Although no output capacitor is needed for stability, it does improve transient response.
3. Required if regulator is located an appreciable dis-tance from power supply filter.

Figure 14 : Constant Current Regulator.



$$I_O = \frac{V_{XX}}{R_1} + I_d$$

Figure 15 : Circuit for Increasing Output Voltage.



$$I_{R1} \geq 5\ I_d$$

$$V_O = V_{XX}\ (1 + \frac{R_2}{R_1}) + I_d\ R_2$$

Figure 16 : Adjustable Output Regulator (7 to 30V).

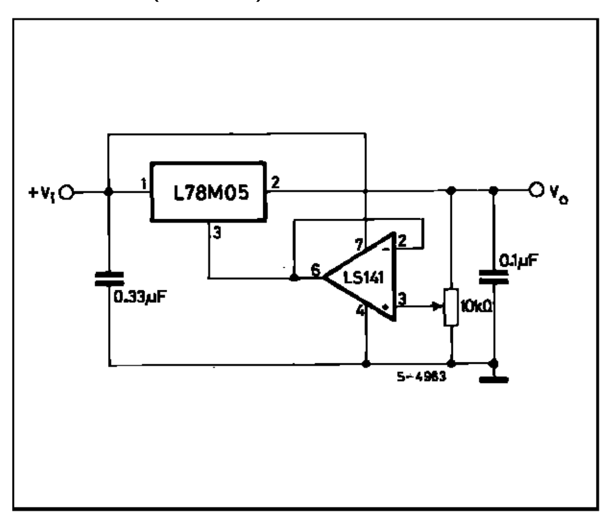
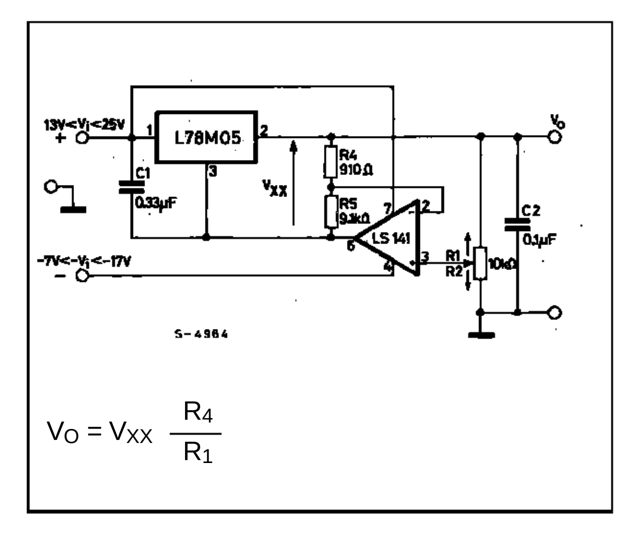
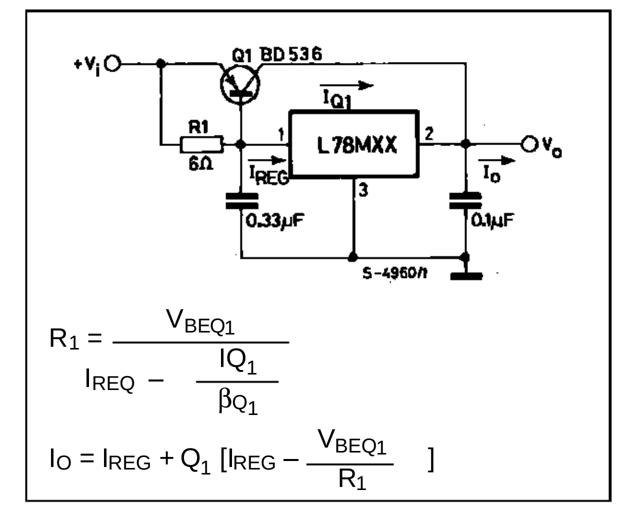


Figure 17 : 0.5 to 10V Regulator.



$$V_O = V_{XX} \frac{R_4}{R_1}$$

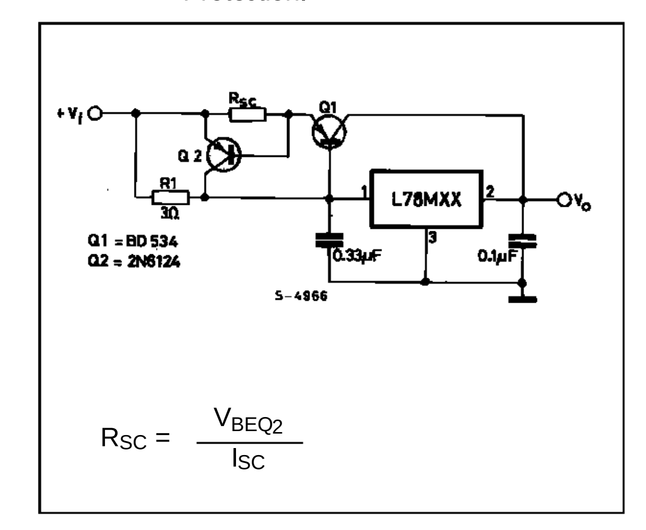
Figure 18 : High Current Voltage Regulator.



$$R_1 = \frac{V_{BEQ1}}{I_{REQ} - \frac{IQ_1}{\beta_{Q1}}}$$

$$I_O = I_{REG} + Q_1 \left[I_{REG} - \frac{V_{BEQ1}}{R_1} \right]$$

Figure 19 : High Output Current with Short Circuit Protection.



$$R_{SC} = \frac{V_{BEQ2}}{I_{SC}}$$

Figure 20 : Tracking Voltage Regulator.

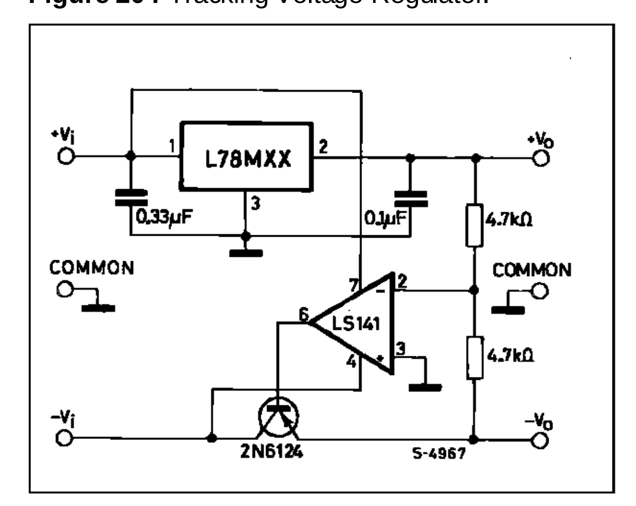
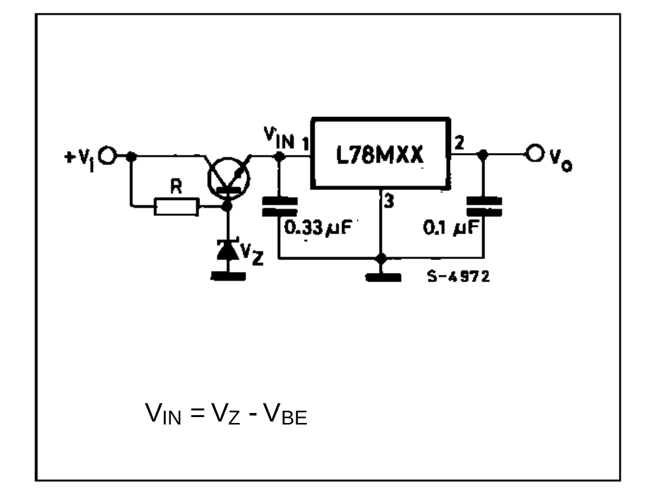
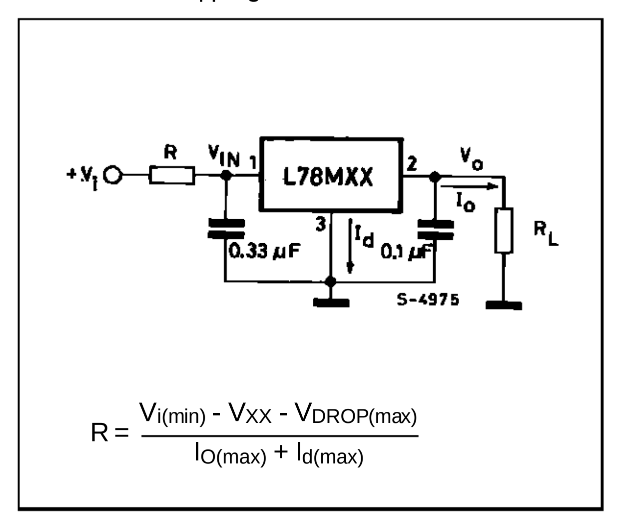


Figure 21 : High Input Voltage Circuit.



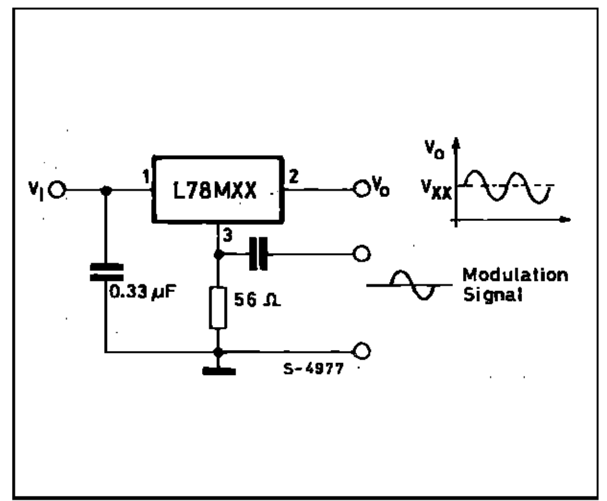
$$V_{IN} = V_Z - V_{BE}$$

Figure 22 : Reducing Power Dissipation with Dropping Resistor.



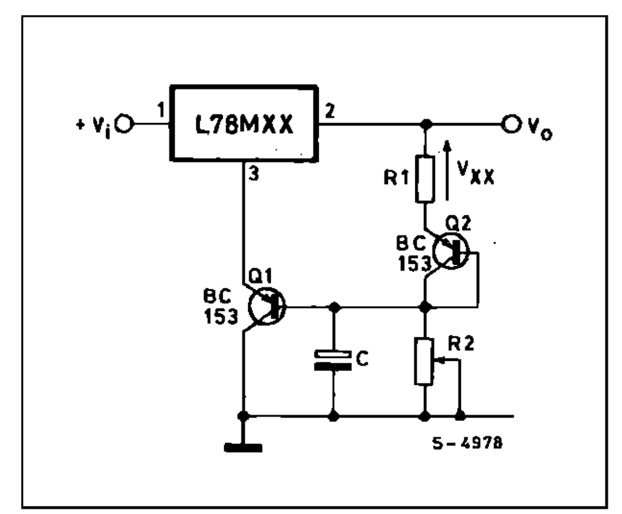
$$R = \frac{V_{i(min)} - V_{XX} - V_{DROP(max)}}{I_{O(max)} + I_{d(max)}}$$

Figure 23 : Power AM Modulator (unity voltage gain, Io ≤ 0.5).



Note : The circuit performs well up to 100KHz.

Figure 24 : Adjustable Output Voltage with Temperature Compensation.

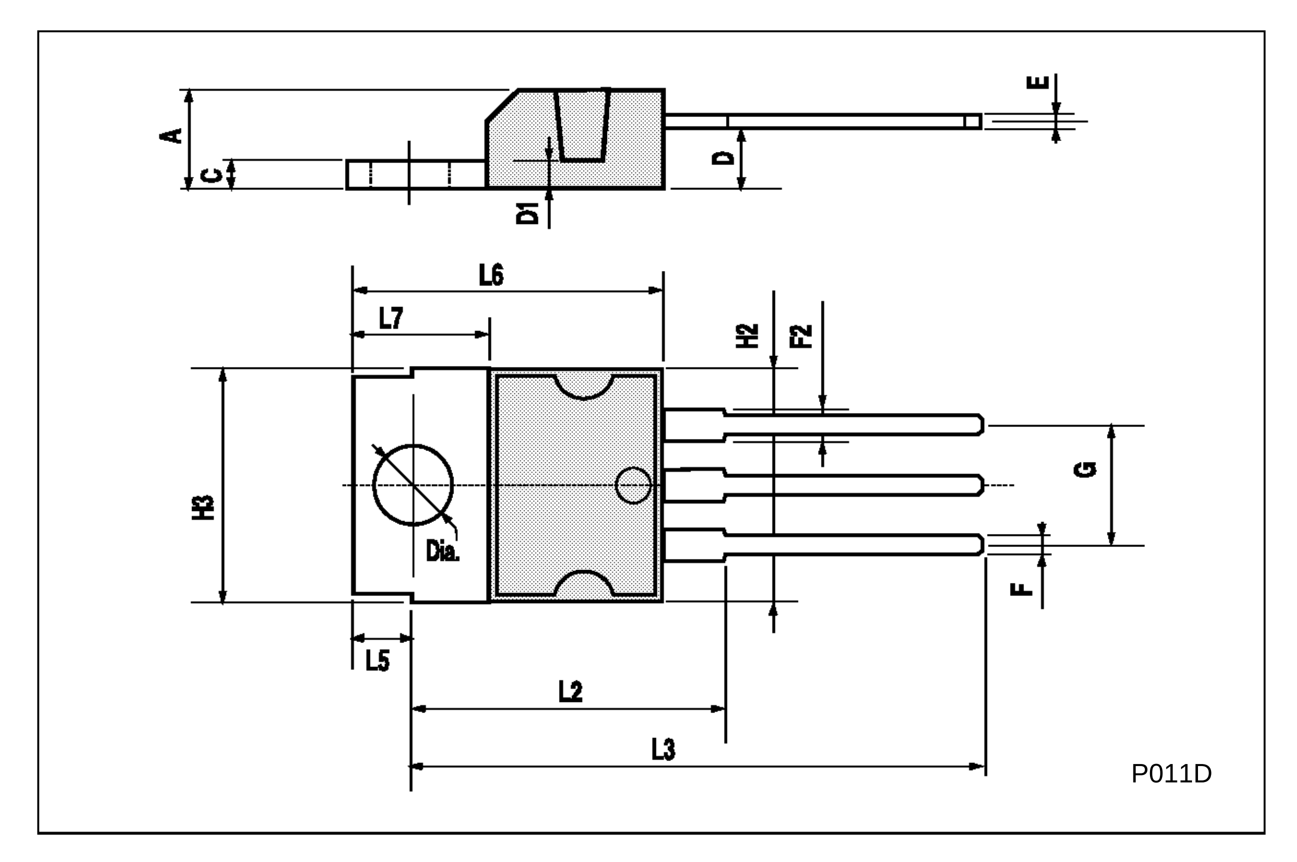


Note : Q_2 is connected as a diode in order to compensate the variation of the Q_1 V_{BE} with the temperature. C allows a slow rise-time of the V_O

$$V_O = V_{XX}\left(1 + \frac{R_2}{R_1}\right) + V_{BE}$$

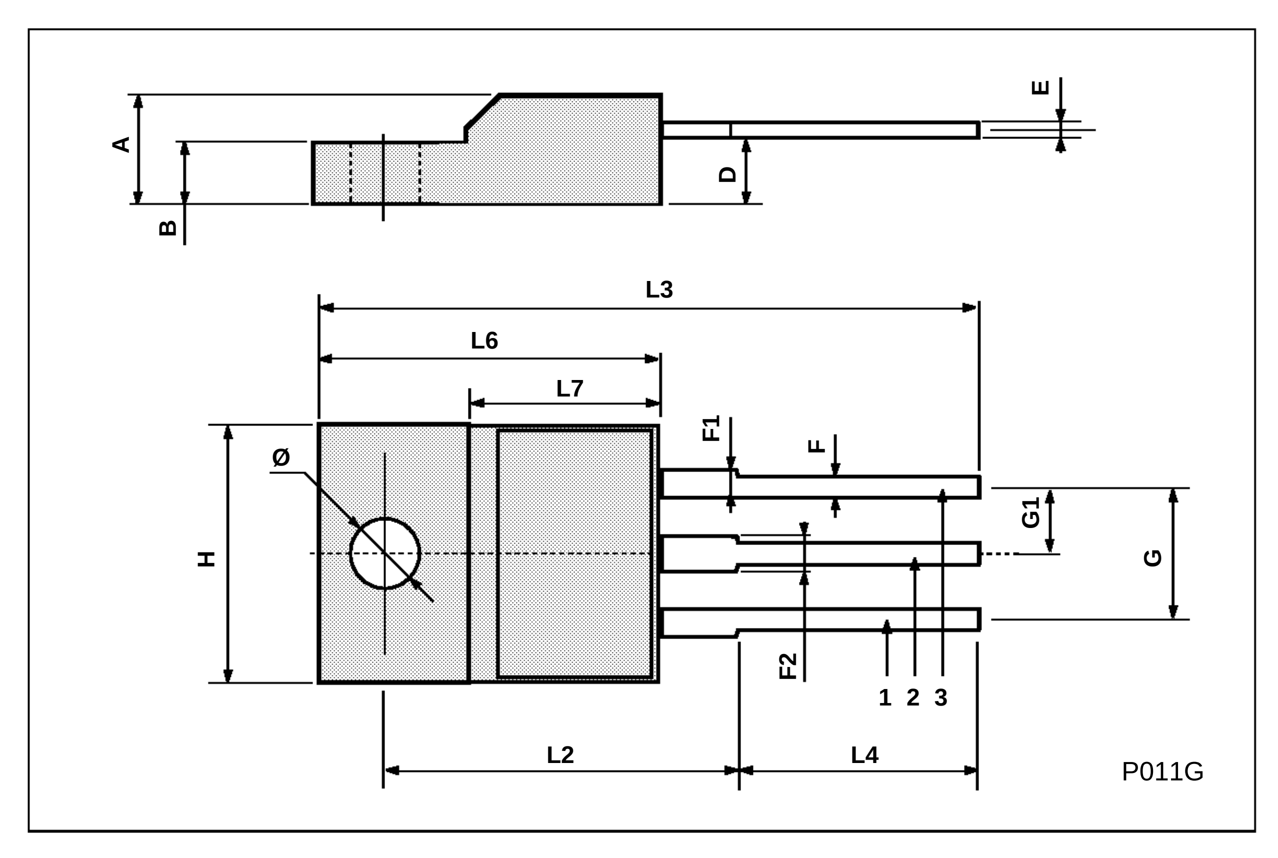
TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.8		1.05	0.031		0.041
F2	1.15		1.4	0.045		0.055
G	4.95	5.08	5.21	0.195	0.200	0.205
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L2		16.2			0.638	
L3	26.3	26.7	27.1	1.035	1.051	1.067
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
Dia.	3.65		3.85	0.144		0.152



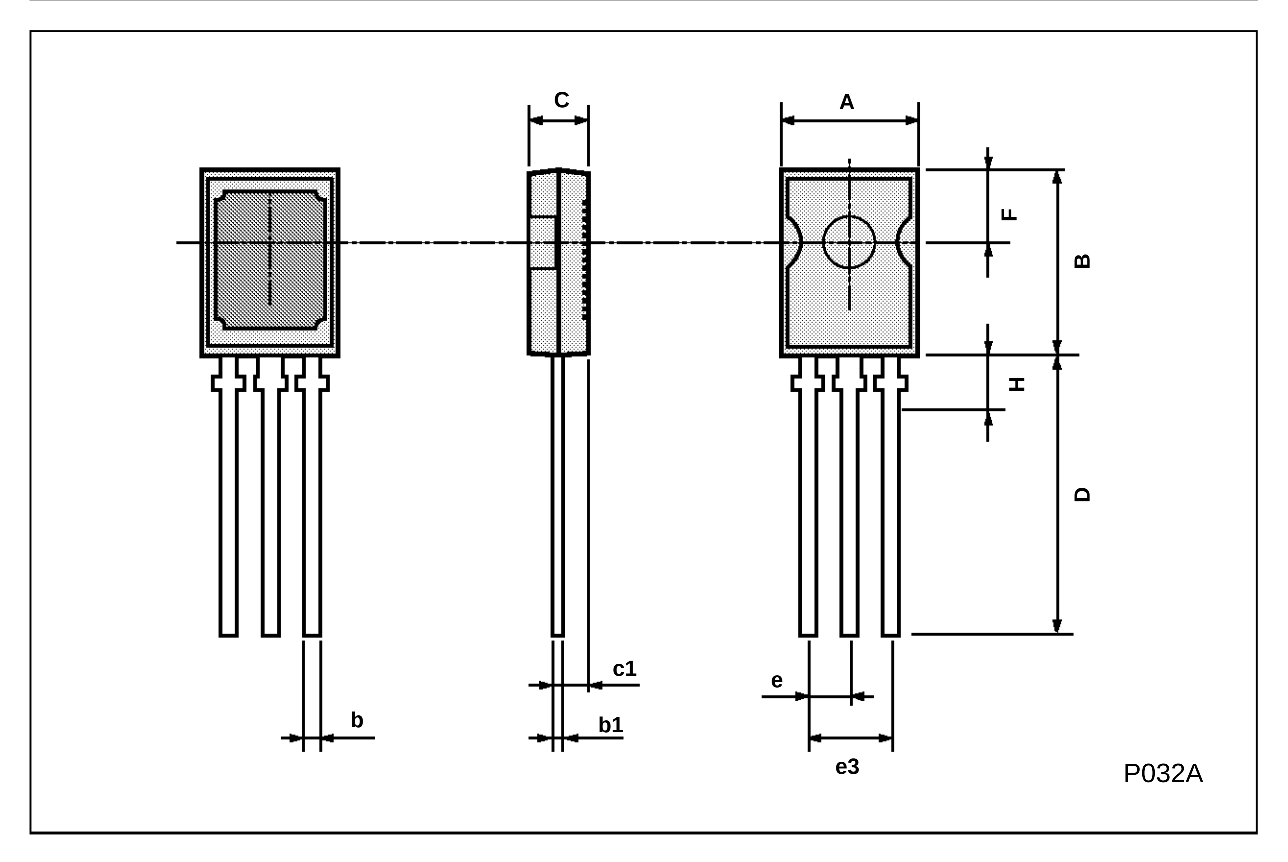
ISOWATT220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.4		0.7	0.015		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



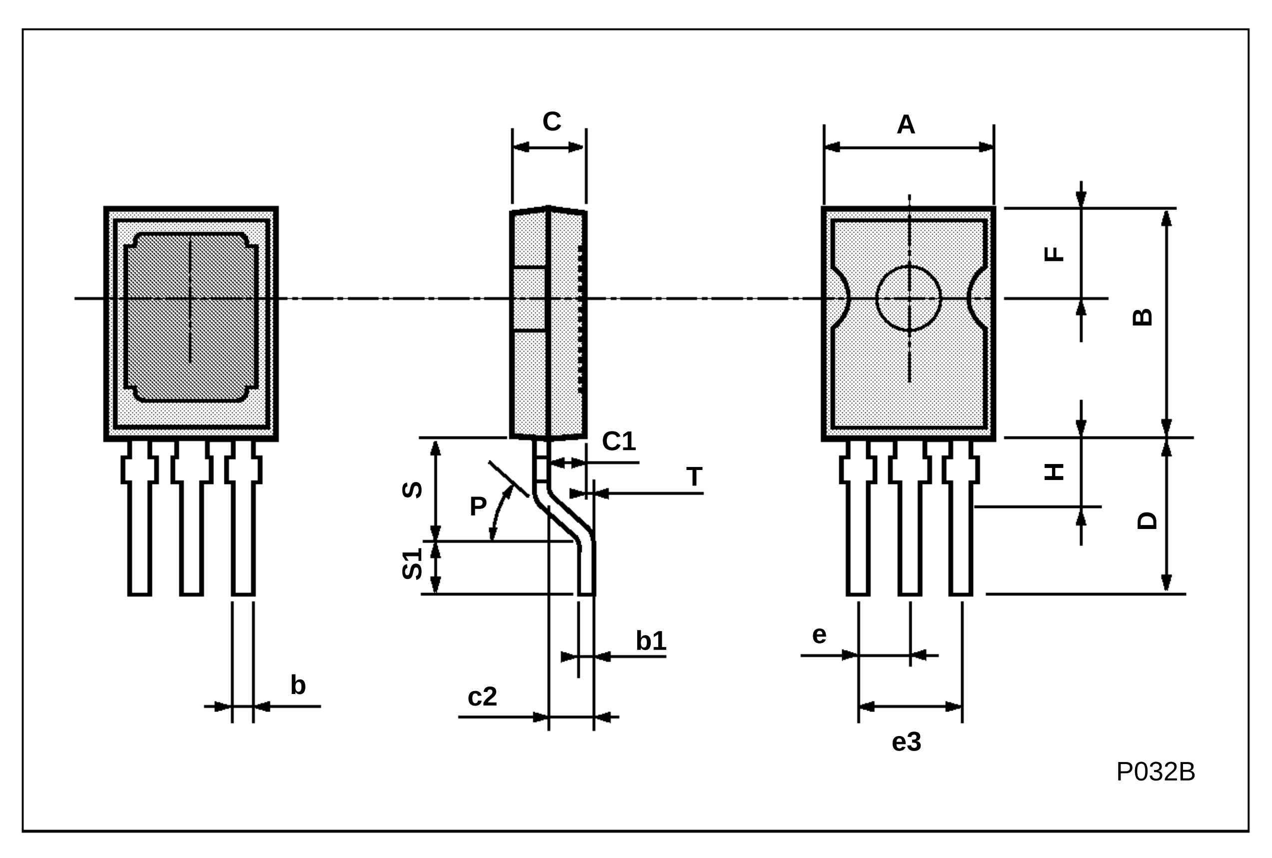
SOT-82 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	7.4		7.8	0.291		0.307
B	10.5		11.3	0.413		0.445
b	0.7		0.9	0.028		0.035
b1	0.49		0.75	0.019		0.030
C	2.4		2.7	0.04		0.106
c1		1.2			0.047	
D		15.7			0.618	
e		2.2			0.087	
e3		4.4			0.173	
F		3.8			0.150	
H			2.54		0.100	



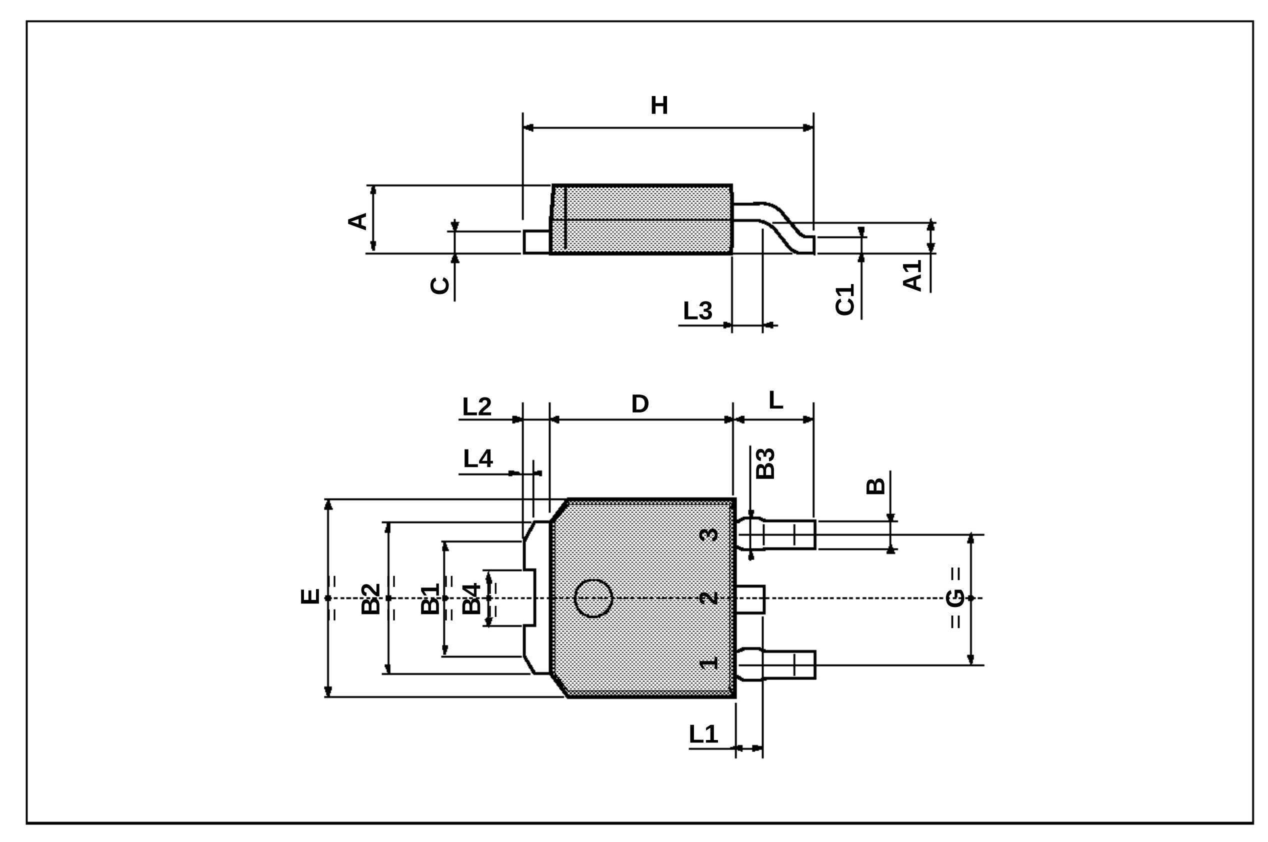
SOT-194 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	7.4		7.8	0.291		0.307
B	10.5		11.3	0.413		0.445
b	0.7		0.9	0.028		0.035
b1	0.49		0.75	0.019		0.030
C	2.4		2.7	0.094		0.106
c1		1.2			0.047	
c2		1.3			0.051	
D		6			0.236	
e		2.2			0.087	
e3		4.4			0.173	
F		3.8			0.150	
H			2.54			0.100
P	45° (typ.)					
S		4			0.157	
S1		2			0.079	
T		0.1			0.004	



TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
B	0.64		0.8	0.025		0.031
B1	3.4		3.6	0.133		0.141
B2	5.2		5.4	0.204		0.212
B3			0.9			0.035
B4	1.9		2.1	0.074		0.082
C	0.48		0.6	0.018		0.023
C1	0.45		0.6	0.017		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	2.55		3.05	0.100		0.120
L1	0.6		1	0.023		0.039
L2		0.8			0.031	
L3	0.8		1.2	0.031		0.047
L4	0.3		0.45	0.012		0.017



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